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Aircraft Engines

I READ an interesting article by Mr. Glenn D. Angle the other day in the *Aero Digest*. It was a more or less detailed discussion of the developments in high-powered aircraft engines, in fact as I understand it there is to be a series of such articles; the first one appearing in the October issue. Mr. Angle begins by giving a brief history of the development and progress made by different countries in constructing large power plants. By large power plants in aircraft engines we usually refer to engines of more than 600 horsepower. It might be interesting to know that the largest amount of horsepower to be developed in one engine to date is 2800. For such an engineering feat, we must recognize the wonderful design of the Fiat company of Italy.

In summarizing the status of high-powered aircraft engine development nine years ago, we find that there were about thirteen designs which had been built with an output of 600 or more horsepower. Seven of these originated in France, three in Great Britain, one in Italy, and two in America. The practical advantage of the engines built in France, however, was confined mostly to the blue prints as we see that only one of the seven ever passed the experimental stage. Britain commanded much attention through the Napier "Cub." This engine at that time was the only one to actually deliver 1000 horsepower, and we find it to be of an unconventional arrangement. It was composed of sixteen cylinders arranged in four rows of four each. These rows formed an irregular X. Italy was well represented by the Fiat A-14. This engine was most remarkable in the fact that it was produced in larger numbers than any of the others in its power class. The Army Air Service undertook to represent the United States in engine development by building the W-1-A. A notable fact about this engine was that it was the first eighteen cylinder W type engine to be constructed in this country. During the war Duesenberg designed a sixteen-cylinder V type engine, but it failed to meet expectations and so was never put on a production basis.

The most powerful aircraft engine constructed to date is the Fiat A-S-6, rated 2800 h.p. at 3200 r.p.m., and is said to weigh only 2050 lbs., or .732 lbs. per h.p. Not only is this engine featured by its great output and low weight, but it marks a new step in construction. The motors A-S-3 and A-S-5, both Fiat productions, also give due credit to the pioneering done by this great Italian firm. The weight of the A-S-5 represents less than three-quarters of a pound per horsepower. Another well-known Italian firm is Isotta-Fraschini, the largest producers of aeronautical engines in Italy. They are especially recognized for their 1800, 1100, and 1000 horsepower engines. The recent flight of twenty-four sea planes from Italy and return has demonstrated the dependability of the Isotta-Fraschini products.

From a review of the progress in France during the past nine years, we find that six manufacturers have been active in developing engines of large output; five of these have built engines of 1000 or more horsepower, and at least four are still engaged in this field. The aircraft engine manufacturers of France as a whole have risen from no more than fourth position to among the leaders producing high-powered units. Perhaps the most significant feature in their progress is the actual construction and development of the open-W types by Hispano-Suiza and Farman, which are not only ideally suited for large units from an engineering standpoint, but are especially adaptable for airplane installation.

British engine manufacturers have been constantly improving without seriously attempting to build units of greater displacement. The program of Rolls-Royce with the "Condor" has already been referred to but of more interest is the development of the H and R types of engines. The model H was used in the ship winning the Schneider Trophy Race of 1929. D. Napier & Sons, Ltd., it seems abandoned the development of the 1000 h.p. "Cub," but this firm stepped up the performance of the "Lion," their well-known twelve-cylinder W type engine. Sunbeam has proceeded with the development of the twelve-cylinder "Sikh," while we find Beardmore confining their operations to designs which operate on heavy fuels. Bristol and the Armstrong-Siddely Factories have come forth to the front with nine-cylinder and fourteen-cylinder engines respectively. Both engines are of high horsepower ratings.

Bombardment Aviation

During the world war the percentage of destruction done by airplanes was very small and about the biggest advantages of such weapons were to drive off enemy airplanes and to sight enemy position. Today the situation is quite revised, but since we are only interested in bombardment in this article we shall naturally only refer to this form of warfare. Instead of the large, slow, clumsy bombers we have swift neat planes capable of carrying the same bomb load of 2400 lbs. Thus of the four classes of aviation used for military purposes, bombardment, aviation is now recognized as the basic arm, with pursuit, attack and observation aviation as supporting arms in fulfilling the mission of bombardment.

Major General James E. Fechet of the U. S. Army (Ret.) has discussed briefly, in the *Aero Digest*, the possibilities, the characteristics, and uses of these new super bombers. After having read this article, it takes a wide scope of imagination to picture what a squadron of such bombers might do, providing they were perfectly organized against enemy attacks.

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Maj. Gen. Fechet in describing the characteristics of the new bombers says that they must be small in order to provide a smaller target for anti-aircraft artillery, and that the smaller the plane the easier it is to house. The wing spread, however, must be large enough to get the required ceiling. The fuel consumption is another important question which enters here. With a bomb load of 2400 lbs., bombers at maximum speed should be capable of going a distance of 400 miles and return, as the ratio of gasoline consumption to distance traveled at cruising speed is much less than at maximum speed. Thus the radius of action will be increased by flying at cruising speed.

The element of surprise is essential to the success of a bombardment attack, and as a result, rapid strides have been made to reduce the noises resulting from engine exhaust, propellers, and vibration wires. High ceiling and rate of climb also lessen the possibility of detection by the enemy, while at the same time increases the errors in the fire of anti-aircraft artillery.

In the last war the bombardment planes depended too much on smaller planes for protection against enemy attacks and on luck against anti-aircraft artillery. With the new designs a speed of 200 miles per hour is attainable at an altitude of 15,000 feet. This means that if an anti-aircraft gun fired at one of these bombers, the plane would have gone 4000 feet before the shell would reach the same altitude. A high speed bomber also provides some defense from pursuit aviation, and in case of necessity is able to assist other crafts in fighting off an attack. Another characteristic which must be considered under this phase is that of vision for the pilot and bomber. Both must have a constant and unrestricted view of the ground to increase efficient navigation and good bombing. The pilot must have good fore and aft vision to enable him to see other airplanes in the formation and there must be no blind angle that cannot be covered by one of the two or more gunners.

Correcting a Compass

The average person who sees a ship sail gracefully out to sea, little realizes what a large problem it is to keep that ship on the right course for its destination. The passengers on the ship seldom think that the very iron and steel which bears them across the briny deep and forms the luxurious comforts afforded by modern ships, are the things which tend to cause disaster. The earth underneath the water does its part too in disturbing the mariner's guide. In fact there is possible interference for the compass wherever there is a substance which can transfer electrical energy or form a magnetic field. The compass being an instrument so necessary for accurate navigation, we are deeply concerned in these errors that enter into the compass readings. There are two such errors which the mariner compensates for; namely, variation and deviation. Under the heading of variation, we refer to the error as caused by the magnetic attraction of the earth; and under

deviation we concentrate our work on the error caused by the magnetic attraction of the material used in building the boat.

Since man is able to control, to a certain extent, the amount of deviation error, it is interesting to know just how compasses are corrected and adjusted. Mr. Wendell Holmes, through Motor-Boating, has presented to us his interview on this subject with Bob Beekman, a past master in the art of compass adjusting.

In putting a faulty compass in order, Mr. Beekman uses an instrument called the pelorus. This instrument is placed on the deck of the ship in such a manner that the north and south points on its dial are parallel to the ship's keel. The correct local sun time is then taken and combined with the figures of the latitude of operation and the sun's declination to get the sun's true bearing on the pelorus. To secure the correct magnetic reading, it is necessary to apply the variation at the place of observation to the reading on the pelorus. The difference between the correct magnetic reading and the compass reading is the amount of deviation. The correction may be made on the compass by adjusting a system of auxiliary magnets. This is done for all 32 points of the compass.
